REMARKS

I. Drawing Changes

The drawing figures were objected to under 37 C.F.R. 1.83 (a) for not showing every feature of the invention specified in the claims.

The drawing figures were also objected to under 37 C.F.R. 1.84 (p) (5) for including reference sign(s) not mentioned in the description.

The voltage regulator VR was not indicated in the originally filed drawing figures or the components in the drawing that are part of the voltage regulator are not indicated in the figures. Method claim 9 has been amended to delete the "voltage regulator", since the essential features of the applicants' inventive method can be described without showing a "voltage regulator", which is old in the art, in the figures. The specification does not describe or specify the "voltage regulator" that controls the output voltage, or the manner in which the specified components are connected with it.

No parts shown in the drawing figures have been indicated as the voltage regulator or parts of the voltage regulator. No new matter has been entered in the drawing figures.

Correspondingly the reference number VR has been deleted from the two paragraphs in which it occurs in the specification, since this reference character does not appear in the drawing figures. Also these paragraphs in the specification have been amended to state that the voltage regulator is not shown in the drawing.

A copy of the first sheet of drawings (1/2) accompanies this amendment, with a proposed change on figure 1. The drawing reference number "13", which was not mentioned anywhere in the specification or claims, was been deleted from figure 1.

Approval of the proposed change in figure 1 is respectfully requested.

Withdrawal of the objection to the drawing under 37 C.F.R. 1.83 (a) is respectfully requested in view of the cancellation of the "voltage regulator" from claim 9.

The new claim 18 includes subject matter from canceled claim 9. The new claim 18 does not refer to a "voltage regulator". However it does include the step of regulating the output voltage of the generator by controlling the exciting current passing through exciter coil 14. Since this step is a method step, means for such regulating and this regulating step itself are notoriously well known in the prior art, it is not necessary to include any additional illustration in the figures to support this part of new claim 18.

Withdrawal of the objection to the drawing under 37 C.F.R. 1.84 (p) (5) is respectfully requested in view of the deletion of reference number "13" from figure 1.

II. Claim Changes and Basic Description of the Invention

New claims 10 to 18 have been filed, which more particularly point out and distinguish the invention in relation to the prior art than the original canceled claims 1 to 9.

New method claim 10 is the only independent claim and is based on an adequate description in the specification. Claim 10 includes the essential distinguishing features of the claimed method that separate its subject matter from the prior art. However details of the entire method for controlling the output voltage of a claw pole generator that are old or well known in the art, especially the methods for regulating output voltage by controlling exciter current, are not included in the new method claim 10. The recited features of the claimed method in claim 10 are the distinguishing features of an improvement of this old and well-known method for controlling a claw pole generator with an exciter coil. The voltage regulating procedure however is given priority to the procedures according to the invention to provide additional charging currents, e.g. for faster starting, during operation of the generator. Nevertheless applicants' inventive improvement to the methods of generator regulation should not be limited to any particular method of regulating output voltage by controlling exciter current that is currently used in the art.

Fundamentally, at least for the preferred embodiments, the inventive method comprises measuring a current at some point in the generator circuitry connected with the windings with a current measuring device, comparing the measured current with a maximum threshold value, temporarily supplying additional charging current to individual windings in addition to the induced current that is already in the windings during an otherwise or normally currentless time interval for that winding, when the measured current is below the threshold value by making associated switching elements conducting and then blocking

these switching elements when the m asured current exceeds th threshold value. Note the switching elements are sometimes called "valves".

The term "additional current" means current supplied to the stator windings in addition to the induced current in the windings due to excitation with the exciter current Ierr during regulation of the generator to control the generator output voltage.

The term "otherwise currentless time interval" means a time interval during which current would not be present in one of the windings, when the controlling step b) of the invention does not take place. That means that additional charging current is not supplied to the windings because the method of the claimed invention is not performed (i.e. the situation in the corresponding prior art generator without the features of the invention).

III. Rejection of claims under 35 U.S.C. 112, first paragraph

Claims 1 to 9 were rejected under 35 U.S.C. 112, first paragraph, for being based on an inadequate written description.

New claims 10 to 18 have been filed and claims 1 to 9 have been canceled, obviating the rejection of claims 1 to 9.

It well established that the written description requirement involves the question of whether the subject matter of the claim conforms to that of the disclosure (M.P.E.P. 2163.01). The standard for satisfying the written description requirement is set forth in M.P.E.P. 2163.02. That standard appears to be largely satisfied when the wording of the claimed invention is explicitly or literally present

in the originally filed specification according to M.P.E.P. 2163.02. Also this requirement is different from the enablement requirement, which requires that the description should be sufficient so that one skilled in the art can adequately practice the claimed method. Both requirements are considered here.

1. Written Description Requirement

The literal claim wording of the new claim 10 appears in various parts of the description, especially the description of the preferred embodiments, in the originally filed specification on pages 5 to 9.

The wording regarding the apparatus in the preamble of method claim 10 is supported by the features shown in figures 1 and 4 particularly. These figures show that the generator is separate but connected to the converter bridge (Fig.1) and that a direct current IG is produced by the converter bridge, which acts as a rectifier (Fig. 4). These conclusions are supported by the paragraph on page 5, lines 7 to 17.

It is respectfully submitted that all wording of new claim 10 has some literal basis in various separate parts of the specification, so that new claim 10 is adequately based on a written description that supports both the literal wording and meaning of the claim steps a) and b) of method claim 10.

Step a) of claim 10, measuring a current of the generator and/or the converter bridge with current detector 24, and the limitation that the controlling of step b) takes place according to a "measured current value" in step b) have basis in the description of the preferred embodiments on pages 7 to 9 of applicants' specification (Figs. 7 to 9). It is also based on the illustration in Figs. 2 to 4. Such

current detectors are known in the art, as mentioned in more detail below, and thus their details need not be included in the description of applicants' invention.

Basis for the wording in the first three and last four lines of step b) of claim 10 is present in the specification in the paragraph extending between page 5, line 18, to page 6, line 3, and also see original canceled claim 1, lines 7 to 10.

Basis for the added wording "independently of natural ignition or turn on times of the switch elements" is found on page 4, lines 1 to 3, of the originally filed specification in this CIP.

The term "otherwise currentless time interval" is explained in the paragraph between page 6, lines 4 to 16, of the applicants' specification. Also note the disclosure in the paragraph between line 3 and 6 of page 7 and in line 21 of page 7. The switch elements of the rectifier bridge 11 are controlled by an unshown control unit or voltage regulator to produce a direct current IG (shown in Fig. 4). The regulating method for the output voltage of the generator with the voltage regulator is claimed in part in claim 18, but the details of this method are old in the art. Applicants do not want to limit their invention to the details regarding how the voltage output is regulated, e.g. as shown in the Chambers U.S. Patent reference.

It well established that

> "A patent need not teach, and preferably omits, what is well known in the art". Hybritech Inc. v. Monoclonal Antibodies Inc. 231 USPQ 81 (Fed. Cir. 1986).

Thus the details of the output voltage regulation need not and should not be

shown because they are old in the art. Applicants' additional switch element control procedures are in addition to the procedures used for output voltage regulation.

As noted in the above-cited parts of the specification the additional current is supplied to a stator winding as soon as the phase current in that winding has a zero crossover (page 6, lines 9 to 11). This is the start of the "otherwise currentless time interval" for that winding. With respect to canceled claim 3 and new claim 12, this time of zero crossover is the "turn-on time" referred to in claim 10, i.e. the time at which the additional current is supplied to that stator winding. The "longest on-time duration" is of course the time interval between the "turn-on time" and the time at which the additional current to the stator winding is turned off by switching the associated switch element to blocking or non-conducting. This turn-off time is determined by the current measurement with the detector 24. The embodiments shown in Figs. 2 to 4 provide several different methods for determining the turn-off time depending on measurements of current in different parts of the generator circuitry.

The wording in claim 12 regarding "turn-on time" and "longest on-time duration" is supported by page 6, line 9 to 21.

Thus the wording of steps a) and b) in the new independent method claim 10 and also 12 is explicitly supported by the wording, especially on pages 5 to 9 of the specification and the disclosure clearly shows that the applicant had possession of the invention claimed in new claims 10 to 18.

2. Enablement

The method of regulating generator output voltage by controlling excitation current of a generator and the features of a generator that are required to perform this type of control or regulation are notoriously well known in the automotive engineering arts. Therefore there is no need to explain how the voltage regulation by control of exciter current works in the specification, since methods for doing that are well known in the art. This voltage regulation is typically given higher ranking or priority than the controlling step b) during regulation of concrete embodiments as explained on page 7, line 21 and following of applicants' specification. See also page 7, lines 3 to 6.

The present claims do not refer to the "voltage regulator" which controls the excitation current, but one skilled in the art would understand that the regulation of the exciter current referred to in claim 18 could be performed with a conventional voltage regulator. One skilled in the art would understand how to make and use a voltage regulator controller to control the switching elements of the rectifier bridge 11 to regulate the output voltage of the direct current output from the rectifier bridge.

The circuitry for performing improved regulation according to the invention shown in Figs. 2 to 4 is in addition to that required to perform the regulation of the exciter current to control the output voltage of the generator, which must be provided. The switching elements in the known generator circuitry for regulating output voltage include a bridge circuit with field effect transistors, which are controlled by e.g. a control unit according to U.S. Patent 5,132,604, which has

also been cited. This control unit controls the field-effect transistors so that a rectification occurs. That means that during one of the half-waves of the output voltage of the generator they are conducting and in the other they are blocking. Again this is a well-known procedure and is employed also in concrete generator circuitry including components to perform the applicants' claimed improved regulating method of claim 10.

Furthermore the switches shown in Fig. 1 in the bridge are in fact field effect transistors or their equivalent, because the equivalent circuit for a field effect transistor is known to be an ordinary transistor with a diode connected in parallel across it. See, e.g., elements 127 to 129 of Fig. 5 of Shimane, et al.

Thus one skilled in the art would know how to construct, connect and control the switch elements: they are FETs. They are connected as shown in Fig. 1.

Furthermore current detectors like those shown in Figs. 2 to 4 are well known in the art. An example of a current measurement device for measuring current in a conductor without contact with the conductor by a loop as shown in figures 2 to 4 is described in U.S. Patent 4,309,635, issued to Lienhard, et al. A copy of this reference is filed to show that one skilled in the art would know how to construct a current detector 24 of this type shown in the figures. Also the current sensor could be a Hall effect device.

Logic units, controllers and comparators are also well known components that are available commercially.

Thus one skilled in the art has all the information available necessary to

practice the claimed invention, i.e. to make the circuitry shown in Figs. 1 to 4 for regulating a claw pole generator with an exciter coil 14 and a rectifier bridge, according to the improved method claimed in claim 10.

For the foregoing reasons and because of the wording in the new claims, it is respectfully submitted that **none** of the new claims 10 to 18 should be rejected under 35 U.S.C. 112, first paragraph, for not being based on a adequate written description in the specification and/or for lack of enablement.

IV. Indefiniteness Rejection

Claims 1 to 9 were rejected under 35 U.S.C. 112, second paragraph, for indefiniteness.

New claims 10 to 18 were filed and claims 1 to 9 were canceled. New claim 10 contains similar subject matter to canceled claim 1 above.

This claim for the inventive method has been explained in some detail above. Basically it claims an improvement in the known method for regulating a generator, in which the output voltage of the generator is controlled by controlling the exciter current.

The new claims have been drafted according to U.S. Patent Office Rules, especially regarding antecedent basis for claim terms. Generally the features of the improved method are distinctly pointed out and claimed with precision.

Regarding the specific questions in the Office Action the wording regarding "inductance" is no longer used in the claims. The windings of course

have an inductance and when additional current is passed through them they will be provided with additional magnetizing energy.

Regarding the windings of claim 11: the windings are not selected, the times of feeding current pulses to them are selected. The selection is performed so that an applied phase current is a predetermined minimum size during an otherwise currentless phase.

The "turn on time" and "longest on-time duration" are explained above.

The "measuring instrument" is current detector 24 which measures the size or magnitude of a current, but this former terminology is not used in the claims anymore. The current detector 24 could be current measuring component as explained in U.S. Patent 4,309,655. The "current detector 24" measures the current in the conductor it surrounds.

In a given embodiment the current measuring device 24 would be connected to a single location in the generator circuitry. However more than one current detector could be used to measure more than one current, as explained on page 9 of the specification in some combined embodiments. One measuring device 24 could not measure current at a plurality of different locations.

For the foregoing reasons and because of the changes in the claim wording, it is respectfully submitted that none of the new claims 10 to 18 should be rejected under 35 U.S.C. 112, second paragraph, for indefiniteness.

V. Rejections based on the Prior Art

1. Rejection based on Shimane and Tanaka

Claims 1, 3, 4 and 9 were rejected as obvious under 35 U.S.C. 103 (a) over Shimane, et al, in view of Tanaka, et al.

Claims 1, 3, 4 and 9 have been canceled obviating their rejection based on Shimane, et al, and Tanaka, et al. Claim 10 has been discussed above and contains several additional method step features that distinguish it further from the prior art than claim 1 did. Claims 12, 13 and 18 above correspond to canceled dependent claims 3, 4 and 9.

Shimane, et al, disclose an electrical machine that can be operated alternately as an electric generator for supplying electric power in a vehicle or an engine starter according to control by appropriate control circuitry and a control unit. Thus Shimane, et al, do disclose a method of operating an electrical machine as a generator or the starter motor. The electrical machine does include three stator windings and an exciter coil and is connected to an inverter bridge with switch elements in a similar configuration as in applicants' claim 1. There are many circuit components for controlling the switch elements.

However Shimane, et al, do not disclose or suggest the essential features of the method of regulating an electrical machine operating as a generator producing an direct current IG according to claim 10. Note that claim 10 claims a method of control of generator operation, not an apparatus.

Particularly, Shimane, et al, does **not disclose or suggest** the essential features of the claimed method. These essential features include a) measuring a

current in the generator and/or inverter, with a Hall sensor or the like to obtain a measured value of the current and b) supplying individual stator windings with additional current from a capacitor or battery during otherwise currentless time intervals. That means that additional current is supplied to individual stator windings immediately after zero crossover during generator operation to produce regulated D.C. output, but commutation is delayed by appropriate triggering of an associated switch element. The duration of the time interval during which additional current is supplied is not limited in claim 10.

Shimane, et al, do disclose a current sensor 164, 168 for contactless measurement of current flow from a battery to the electrical machine during operation of the electric machine as a starter motor. An example of this type of current sensor is shown in Fig. 7. This current sensor is used to prevent supply of excessive battery current to the inverter bridge, whose components may be damaged by excessive current (column 11, line 33, to column 12, line 15). However the current sensor 164,168 is only used to measure current supplied to the electrical machine operating as a starter motor, because it measures current in the large-current power supply system for the motor, not the generator (column 10, line 52 to line 60). There is no suggestion in this reference that this current measuring device should be used for regulating current supplied to the stator windings when the electric machine is operated as a generator.

A controller shown in Fig. 3 and described in column 5, line 62 and following to column 8, line 25, controls switching from starter motor operation to generator operation after the starting of the vehicle engine.

Thus although a similar electrical machine with some components that are similar to those shown in Fig. 2 is disclosed in Shimane, et al, Shimane, et al, do not teach or suggest the essential distinguishing features of the applicants' method of operating the electrical machine as a generator.

Tanaka, et al, is only cited to provide the suggestion that a capacitor could be used to store electrical energy and thus supply it at a later time, instead of a battery. Applicants would be willing to concede that a capacitor could be used as a source of electrical energy instead of a battery without Tanaka, et al.

Tanaka, et al, is unrelated to a method of operating a generator because Tanaka, et al, disclose a power supply apparatus for an electric motor. Tanaka, et al, only disclose an electric machine functioning as a drive motor. Therefore this secondary references does not teach or suggest anything regarding a method of operating a generator.

Thus Tanaka, et al, do not provide a hint or suggestion of the modifications of the subject matter of Shimane, et al, related operating the electric machine of Shimane, et al, as a generator to obtain the method of operating a generator as claimed in claim 10.

It is well established by many U. S. Court decisions that to reject a claimed invention under 35 U.S.C. 103 there must be some hint or suggestion in the prior art of the modifications of the disclosure in a prior art reference or references used to reject the claimed invention, which are necessary to arrive at the claimed invention. For example, the Court of Appeals for the Federal Circuit has said:

> "Rather, to stablish obviousness based on a combination of elements disclosed in the prior art, there must be some motivation, suggestion or

> teaching of the desirability of making the specific combination that was made by the applicant...Even when obviousness is based on as single reference there must be a showing of a suggestion of motivation to modify the teachings of that reference.." ***In re Kotzab***, 55 U.S.P.Q. 2nd 1313 (Fed. Cir. 2000). See also M.P.E.P. 2141

In the case of the instant method as claimed in new claim 10, Tanaka, et al, do not suggest the modifications of Shimane, et al, necessary to arrive at a method of operating a generator and associated rectifier bridge with switch elements so that additional currents are supplied to individual stator windings according to a measured current in the generator or rectifier bridge during an otherwise currentless time interval.

The purpose of applicants' method is not related to obtaining a smoother operation, but instead is to provide a faster start up of the generator with more power at lower generator rpm. See for example the paragraph in the specification on page 3, between lines 16 and 20.

For the foregoing reasons and because of the changes in method claim 10, it is respectfully submitted that none of new claims 10 to 18 should be rejected under 35 U.S.C. 103 (a) over Shimane, et al, in view of Tanaka, et al.

2. Rejection based on Shimane, Tanaka and Kohl

Claims 2 and 5 were rejected as obvious under 35 U.S.C. 103 (a) over Shimane, et al, in view of Tanaka, et al, and further in view of Kohl.

New claims 11 and 14 correspond to canceled claims 1 and 5.

Kohl, et al, discloses a voltage regulator for an alternator and method of regulating voltage.

Kohl, et al, only discloses rotation speed measurement and pulse duty factor measurement. Kohl, et al, do not describe means for direct contactless measurement of current at a particular point in the generator circuitry. The purpose is to obtain a measure of voltage drop (column 2, lines 47 to 59).

The method of regulating the generator claimed in Kohl's claims 6 to 9 is a method of regulating the output voltage of an alternator to a battery. Thus this method relates to the unspecified prior art methods of regulating the generator output voltage. It does not suggest or disclose the improved features comprising a) measuring a current in the circuit with a current measuring device and b) supplying additional charging currents to the stator windings during otherwise currentless time intervals for a faster start up or more power at lower rpm.

For the foregoing reasons and because of the wording in the new claims, especially claims 11 and 14, it is respectfully submitted that none of the new claims 10 to 18 should be rejected under 35 U.S.C. 103 (a) over Shimane, et al, in view of Tanaka, et al, and further in view of Kohl.

3. Rejection based on Shimane, Tanaka and Chambers

Claims 6 to 8 were rejected under 35 U.S.C. 103 (a) over Shimane, et al, in view of Tanaka, et al, and further in view of Chambers.

Claims 15 to 17 replaced canceled claims 6 to 8.

Chambers describes a method of operating a generator. The method according to claims 1 to 4 of Chambers involves a generator with an exciter coil and generally relates to supplying or controlling the exciter current in the exciter coil, not the current in the stator windings. Also note the circuit in the figure of

Chambers does not include means for adding additional current to the stator windings or even individual reference numbers for them. It only shows means for controlling current to the exciter winding 12.

In contrast, the method claimed in claim 10 and also claim 16 describes a method of adding additional charging current to the individual stator windings. This speeds up start up and/or provides more power at lower rpm. The charge source 21 is connected directly across the switch elements of the rectifier bridge in applicants' figure 1 and the switch elements are controlled at appropriate times to feed charging current from the charge source into individual stator coils.

The methods of Chambers are basically improved methods of regulating output voltage based in part on current measurements, which involve changing or controlling the exciter current (see step d) of the independent claims of Chambers, et al). In contrast, applicants' method involves adding to stator winding current especially during start up.

Chambers describes a fundamentally different circuit that operates in a fundamentally different way to achieve a different result. Chambers does not disclose or suggest the essential features of the claimed method of claim 10, namely steps a) and b) of claim 10, and thus cannot supply the features that are lacking in Shimane, et al, and Tanaka, et al.

For the foregoing reasons and because of the new wording in the new claims, especially claims 15 to 17, it is respectfully submitted that none of the new claims 10 to 18 should be rejected under 35 U.S.C. 103 (a) over Shimane, et al, in view of Tanaka, et al, and further in view of Chambers.

Should the Examiner require or consider it advisable that the specification, claims and/or drawing be further amended or corrected in formal respects to put this case in condition for final allowance, then it is requested that such amendments or corrections be carried out by Examiner's Amendment and the case passed to issue. Alternatively, should the Examiner feel that a personal discussion might be helpful in advancing the case to allowance, he or she is invited to telephone the undersigned at 1-631-549 4700.

In view of the foregoing, favorable allowance is respectfully solicited.

Respectfully submitted,

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